The Impact of PROGRESA on Food Consumption

JOHN HODDINOTT
International Food Policy Research Institute

EMMANUEL SKOUFIAS
World Bank

I. Introduction

As exemplified by the Millennium Declaration of the United Nations—a resolution signed by 189 countries—the reduction of poverty and hunger is now seen as the central objective of international development (United Nations 2000). Together with 16 other Millennium Development Goals (MDGs), the global community has committed itself to halving by 2015 the proportion of the world' population who live in poverty and suffer from hunger.

One might think that these goals are intertwined. That is to say, interventions that alleviate poverty should automatically reduce hunger. However, the existing literature, as reviewed in Strauss and Thomas (1995) and Hoddinott, Skoufias, and Washburn (2000) suggests this may not be the case. For example, estimates of income-calorie elasticities (measuring the responsiveness of caloric acquisition given changes in income) range from a high of 0.54 (Chernichovsky and Meesook 1984) to a low of 0.01 (Wolfe and Behrman 1983). Further, as Ravallion (1990) stresses, it is also important to consider where within a given distribution such changes occur.

This article contributes to this debate but differs significantly in terms of methodology. Our analysis is based on the impact of an antipoverty program in Mexico called PROGRESA (the Programa de Educación, Salud y Alimentación). Started in 1997, PROGRESA (now called Oportunidades) is the centerpiece of Mexican efforts to fight rural poverty. It provides cash transfers linked to children's enrollment and regular school attendance and to clinic attendance. The program also includes in-kind health benefits and nutritional supplements for children up to age five and for pregnant and lactating women,

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as well as instructional meetings (called *platicas*) on health and nutrition issues. In contrast to earlier programs in Mexico, a unique feature of PROGRESA is the targeting of transfers to the mother of the family. By 2000, PROGRESA reached approximately 2.6 million families, about 40% of all rural families and about one-ninth of all families in Mexico. The program operated in almost 50,000 localities, more than 2,000 municipalities in 31 states, with a budget of approximately $777 million for 1999, equivalent to 0.2% of GDP.

We use a longitudinal sample of approximately 24,000 households from 506 communities located in the first states receiving PROGRESA benefits. Because it was not administratively feasible to provide benefits to all households simultaneously, and because of the importance of correctly assessing program impact, a distinguishing characteristic of this sample was that some communities were randomly selected for participation in PROGRESA (treatment localities), while the rest were introduced into the program at later phases (control localities). We exploit this random allocation to explore whether PROGRESA improved the diet of poor rural Mexicans—a major objective of the program. As such, this evaluation provides insights into whether interventions designed to alleviate poverty also succeed in reducing hunger. Our core finding is that eligible households in the villages receiving PROGRESA benefits increased caloric acquisition compared to eligible households not receiving these benefits. By November 1999, beneficiary households in treatment localities obtained 6.4% more calories than did comparable households in control localities. Perhaps more significant, given recent work summarized by Ruel (2001) that stresses the importance of dietary quality in ensuring adequate intake of essential nutrients, we find that the impact is greatest on the acquisition of calories from vegetable and animal products—a finding consistent with the view of respondents themselves that PROGRESA was enabling them to "eat better."

II. Program Design and Evaluation Issues

The fundamental problem in the evaluation of any social program is the fact that households participating in the program cannot be simultaneously observed in the alternative state of no treatment. For a proper evaluation of the impact of a program it is necessary to observe a group of households that are similar to beneficiary households in every respect possible but do not benefit from the program. In the case of PROGRESA, some localities were randomly selected for participation in PROGRESA (treatment localities), while the rest were introduced into the program at later phases (control localities). However, assuming that a randomized intervention is implemented as designed is a strong, and possibly highly misleading, assumption. A necessary precursor to

our assessment of impact is to consider carefully evaluation design and implementation as well as actual program operations.

Our sample consists of longitudinal data collected from 24,000 households residing in 506 localities in seven states that were part of the third phase of the program's introduction (and, as such, the first to receive PROGRESA benefits): Gurerrero, Hidalgo, Michoacán, Puebla, Querétaro, San Luis Potosi, and Veracruz. These states lie in the southern part of the country and are, by Mexican standards, relatively poor. Of the 506 communities, 320 were designated as treatment and 186 as control communities, implying that at the locality level, there was a 63% probability of a locality being assigned to treatment and a 37% chance of it being assigned to the control group. In control localities the incorporation of beneficiary households into PROGRESA was postponed until the year 2000 (Gomez de Leon et al. 1999).

The selection of beneficiaries into PROGRESA was a three-stage process.[1] Using national census data, poor communities with schooling and health infrastructure were identified. Within selected communities, PROGRESA conducted a census, the ENCASEH (*Encuesta de Caracteristicas Socioeconomicas de los Hogares*), to determine which households, in both treatment and control localities, would be eligible for benefits. Finally, the list of potential beneficiaries is presented to a community assembly for review and discussion, and the list is changed according to established criteria for the selection of beneficiary families. On average in the evaluation sample, 78% of the households were classified as eligible for program benefits.[2]

Given this approach, the first step in developing an appropriate evaluation methodology is to ascertain whether assignment of localities into treatment and controls was in fact random. We draw on the findings of Behrman and Todd (1999), who addressed this issue in detail. Behrman and Todd could not reject the null hypothesis that locality-level means of key characteristics such as age, education, and income were equal in treatment and controls, suggesting that randomization of localities into control and treatment groups was successfully implemented. However, they detected some significant differences when the comparison of the means was conducted at the household

[1] A more detailed description and analysis of the selection process of the PROGRESA beneficiary households can be found in Skoufias, Davis, and de la Vega (2001).

[2] In the early stages of the program, the PROGRESA beneficiary selection method led to approximately 52% of the households in the evaluation sample classified as eligible for the program benefits. By July 1999, PROGRESA added new households to the list of beneficiaries, since it was felt that the original selection method was biased against the elderly poor who no longer lived with their children. As a result of the revised selection process (called *densification*) the fraction of households classified as eligible for program benefits increased from 52% to 78% of the evaluation sample.

level. While the magnitudes of these differences were often very small, this finding suggests that it would be prudent to extend our analysis beyond comparisons of means. The inclusion of control variables accounting for "observable" household heterogeneity will reduce any statistical bias associated with heterogeneity between households in treatment and control localities.

The next step is to determine whether all eligible households in treatment localities were indeed incorporated as prescribed by the PROGRESA operational guidelines.[3] For this purpose, we were given access to the record of payments sent out by the PROGRESA headquarters in Mexico City since the start of the distribution of program benefits in May 1998.

Of the 12,291 households in treatment localities eligible to receive benefits, 3,350, or 27% of the total eligible population, had not received any benefits by March 2000. The most likely explanation for this is that 2,872 households (or 85.7% of the eligible households not receiving any benefits) were never formally incorporated into the program. All of these "forgotten" households were households whose eligibility status was revised from nonbeneficiary to eligible beneficiary as a result of revising the selection process described above. It is less clear why the remaining 478 households (14.3% of the omitted eligible households and 3.9% of the total eligible population in treatment areas) did not receive benefits despite being formally enrolled during the early months of 1998. While it is possible that they chose not to participate, this cannot be verified.

Consequently, we have two options available in order to identify the impact of PROGRESA on food consumption. The first one is to compare potential beneficiaries in treatment areas to potential beneficiaries in control areas. This would provide an estimate of the impact of PROGRESA inclusive of errors in the operational aspects of the program. By construction, however, the estimated impact would be biased downward, since the conditional mean of food consumption or caloric availability among eligible households in treatment areas would be calculated by including the households that were never incorporated for reasons beyond their control.

The other option is to examine whether PROGRESA has an impact that is conditional on households receiving monetary benefits. But at least two critical questions can be raised about this latter option. First, the receipt of benefits may be the result of household behavior or choices that may result in misleading inferences about the impact of the program. Given that the majority of the omitted households were left out of the program for reasons

[3] For a further discussion of the operational aspects of PROGRESA, see PROGRESA (1997) and Adato, Coady, and Ruel (2000).

beyond their control, this issue should not be a major source of concern. Second, the eligible households in the control group may not be the appropriate comparison group. The set of "true" beneficiaries seems to disproportionately exclude smaller, older households. For example, beneficiary households tend to be slightly (5.5%) larger, but considerably younger, than control households. With the number of adults between 18 and 55 years old nearly equal, the main demographic difference between the groups is that beneficiary households have roughly 12% more children (ages zero to 18) and 13% fewer adults older than 55. Since beneficiary households are on average larger than eligible households, their total expenditures may be higher than the total expenditures of eligible households because of the differences in household size and not because of the PROGRESA program. Along similar lines, comparisons of the value of food consumption per capita (consumption divided by family size) may lead to underestimates of the effects of PROGRESA when comparing simple averages. These differences in the samples of beneficiary and control groups suggest that a credible evaluation of the impact of PROGRESA should be based on a comparison of intended (rather than actual) beneficiaries and should use regression methods that control for the household size and age and gender composition of beneficiary and control households instead of simple comparisons of (unconditional) means.

The next step is to ascertain the level of transfers. Even though beneficiaries may have received transfers, the amount they may have received may have been so trivially small as to not affect measurable behavior. Alternatively, if the transfers occur just after our survey data were collected, and households have limited ability to smooth consumption, our data may pick up only limited impact.

PROGRESA's monetary transfers take three forms: a scholarship tied to continued attendance of children at school (the *beca*), money for school supplies, and a cash transfer for food (the *alimento*). These transfers are given out in a lump sum every 2 months. The monthly amount of the scholarships varies by age and sex of the child, ranging (in June 1998) from P 65 for a boy attending third grade to P 240 for a girl attending the third grade of secondary school. These payments were capped with the maximum scholarship transfer set at P 490 per household per month from January to June 1998, rising to P 625 per month from July to December 1999. The *alimento* transfers were pegged at P 95 per month at the start of 1998 but had been subsequently increased to P 125 per month in July 1999. Actual transfers to each household depend on the age and sex of children in the household, as well as their compliance with the requirements of PROGRESA.

Our survey data are referred to as the ENCEL (Encuesta de Evaluación de los

Hogares). The first round took place in March 1998 before the initiation of benefits in May 1998. Unfortunately, the module on consumption was poorly designed, rendering it unusable for the purposes of assessing program impact on food consumption. Additional rounds—with a much improved consumption module—were conducted in October–November 1998 (ENCEL98O), June 1999 (ENCEL99J), and November 1999 (ENCEL99N). Taking advantage of access to administrative records, Hoddinott, Skoufias, and Washburn (2000) determined that by November 1998 (corresponding to the ENCEL98O survey round), beneficiaries selected under the third phase of incorporation were beginning to receive the *alimento* but had, in most cases, received only a single *beca* payment. Payment levels increased subsequently but were highly variable. For example, a typical beneficiary received more than P 500 in December 1998 but nothing in January or February 1999. Payments averaged in excess of P 200 per month in March, May, July, August, and September 1999 but were close to zero in April and November 1999. One reason for this is that the largest component of these cash transfers, the *beca*, was conditional on school attendance. Verification of attendance relies on a process by which households are sent relevant forms, and these forms are completed and ultimately returned to PROGRESA before the initiation of payment. This process takes some time; further, households do not receive school payments for the school holiday period (July–August). Consequently, one would expect there to be some "lumpiness" in the pattern of actual payments made to beneficiaries, a pattern compounded by any delays that might creep into the payment process.

Actual average payments, in total and by component, are reported in table 1. The first monetary benefits associated with participation in PROGRESA start in May 1998, covering, in principle, the first 2 months of participation in the program (i.e., March and April 1998). However, the first payments that were sent out to some households in May 1998 exceeded the maximum bimonthly amount, which suggests that some households were incorporated before March 1998 (e.g., in January 1998). Given that there is no record of the date of incorporation of households into the program, and that initial lags in payments took place because of delays in the processing of the forms necessary for payment authorization, we base our calculation of the average monthly monetary benefits received by PROGRESA beneficiaries on the 12-month interval between November 1998 and October 1999. Average monthly transfers are around P 197 (in November 1998 pesos) per beneficiary household per month. On average, households receive P 99 per month for the *alimento* and P 91 for the *beca*. In households with school-age children, the average *beca* received rises slightly to P 93. The *alimento* accounts for 67.4% of the transfers received by households headed by individuals 60 years old or older, a finding

TABLE 1

PROGRESA TRANSFERS, IN PESOS, TO BENEFICIARY HOUSEHOLDS

	Household Size	Average Monthly Transfers Received	Average Monthly *alimento* Transfer	Average Monthly *beca* Transfer	Average Monthly School Utilities Transfer
All poor households	5.81	197	99	91	8
Households with preschoolers	6.58	202	101	93	8
Households with school-age children	6.59	239	101	128	11
Households with heads age 60 or older	4.35	138	93	41	3

Note. Calculations are based on transfer data provided by PROGRESA averaged across the 12 months period between November 1998 and October 1999 (deflated to November 1998 prices).

that is not surprising given that such households tend to have fewer children of school age. These transfers are equivalent to approximately 20% of total household consumption (the value of food consumed and purchases of nonfood goods, scaled as consumption per month) in control households.

So, while the size of payments is relatively large, the timing and variability in payments carries two additional implications for our approach to evaluation. First, we cannot use, as do Behrman and Hoddinott (2004), Schultz (2004), and Skoufias and Parker (2001), a difference-in-difference estimator because payments were received prior to our first round of usable consumption data. Second, one should expect to observe a much smaller impact of PROGRESA when looking at the ENCEL98O data than when examining the ENCEL99J or ENCEL99N simply because these transfers were of low value.

III. Assessing the Impact of PROGRESA on Food Consumption

A. A Descriptive Assessment

Question: Thinking about your household, what has changed since you began receiving assistance from PROGRESA?
Answers:

"We eat better."	48% of beneficiary households give this response.
"We eat more."	19% of beneficiary households give this response.

Source. Household survey data, November 1998.

We now turn to an examination of the impact of PROGRESA on food consumption. Recall that a key objective of PROGRESA is to improve the health and nutritional status of individuals residing in poor households. Access to food plays an important role in meeting these needs. However, it is important to adopt a fairly broad view of the notion of "access to food." Households do not solely value food quantity. Dietary quality, as exemplified by a varied diet, is also important. Such concerns are clearly in the minds of the PROGRESA beneficiaries in our sample, as the responses to the question about the impact of PROGRESA illustrate.

We begin by exploring whether PROGRESA has led to an increase in the physical consumption of food. To do so, we constructed a measure of caloric availability at the household level. The ENCEL98O, ENCEL99J, and ENCEL99N contained a set of questions of the following form, "In the last seven days, how much have you consumed of the following foods?" This asked with reference to 35 different foods. Converting these data into calories involved the following steps. First, different units of measurement were converted into a common measure for each food item. Next, volumes were converted to

weights using the *Tablas de valor nutritivo* for Mexico (Muñoz de Chávez et al. 1996). The acquisition of each food item, now expressed in kilograms, was multiplied by the percentage weight of the food deemed edible, and these edible kilograms of food were converted to kilocalories again based on information found in the *Tablas de valor nutritivo*. These 35 food variables and their aggregate, expressing calories per family per week, were then converted to daily amounts and divided by household size to get caloric availability per person per day. This measure of household size excludes members not regularly eating in the home and includes nonhousehold members who eat there.[4]

There are a number of reasons why one should be careful in interpreting these data. First, these are rough estimates of calories "available" to be consumed rather than actual consumption data. Second, there can be considerable heterogeneity with broad food categories such as "chicken" or "rice," and such heterogeneity may be correlated with household characteristics. For example, a 100-gram serving of boneless chicken will have more calories than a 100-gram serving of chicken wing with bones. Third, households may consume food outside the household, and such consumption is not reflected in these data. Fourth, there is some evidence in the data to suggest that reported caloric availability falls dramatically in large (more than 10-person) households, suggesting that for these (few) households, measurement error may be a matter of considerable concern.

Mindful of all these caveats, we provide descriptive information in figure 1 as well as in table 2. Figure 1, parts *a* and *b*, presents kernel density estimates, using an Epanechnikov kernel, for the log of daily per capita caloric availability. Figure 1, part *a*, shows these densities for all PROGRESA-eligible households in treatment and control villages in October 1998. The density function for households in treatment localities lies slightly to the right of that for households in control localities, but the difference is not particularly pronounced, and, indeed, at low levels of caloric availability, the two density functions overlap substantially. While a Kolmogorov-Smirnov test statistic rejects equality of these distributions, it does so only with a *P*-value of .024. By contrast, the density functions for caloric availability in November 1999 for households in treatment localities lie to the right of those of control households at all points in the distribution, and the Kolmogorov-Smirnov test statistic rejects equality of these distributions at a *P*-value of less than .0001.

Table 2 provides descriptive statistics of caloric availability at three points in the distribution, the twenty-fifth, fiftieth (median), and seventy-fifth per-

[4] We experimented with various measures of "adult equivalent units," but such adjustments do not substantively affect the results presented here.

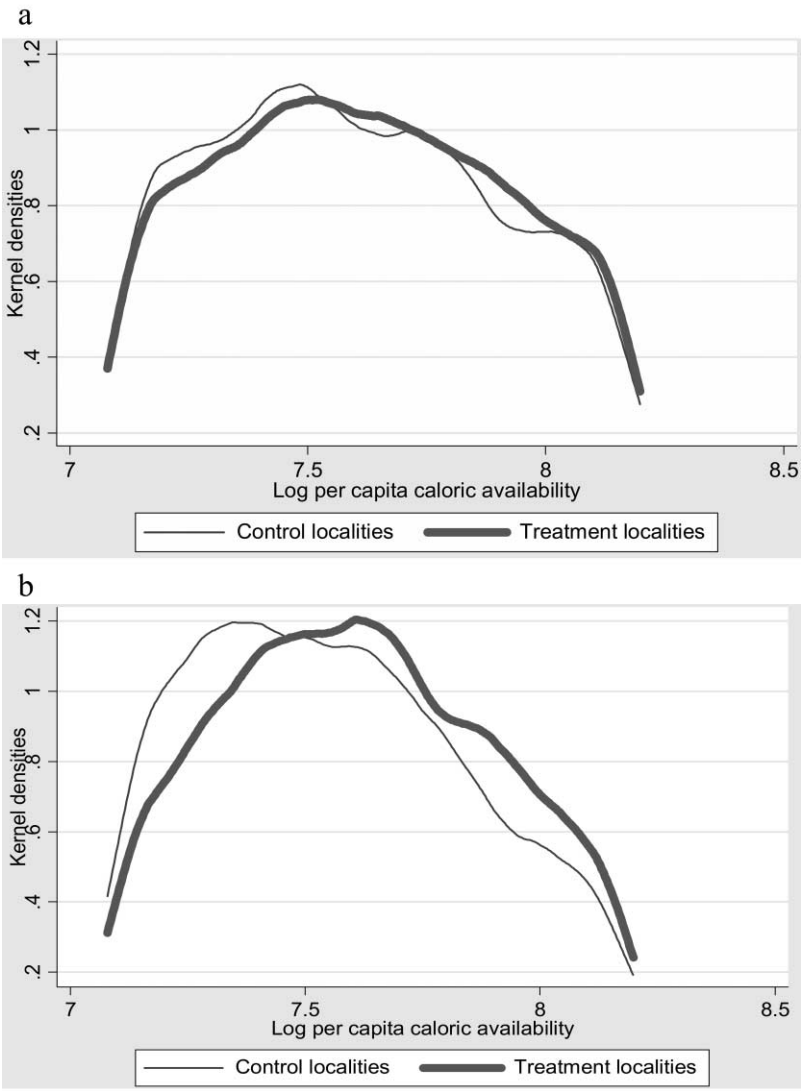

Figure 1. *a*, Kernel densities, caloric availability, October 1998; *b*, kernel densities, caloric availability, November 1999.

centiles among eligible households in the three survey rounds. These data are also disaggregated by food group: grains, fruit and vegetables, animal products, and other foods.

Beginning with the October 1998 survey round, there are several noteworthy features. The first is the monotony of the diets of these poor Mexican households, with calories from grains accounting for about 75% of caloric availability.

TABLE 2

PER CAPITA CALORIC AVAILABILITY IN TREATMENT AND CONTROL HOUSEHOLDS BY SURVEY ROUND

	25th Percentile			Median			75th Percentile		
	Treatment	Control	Percent Difference	Treatment	Control	Percent Difference	Treatment	Control	Percent Difference
All foods:									
October 1998	1,591	1,564	1.7	2,015	1,963	2.6	2,601	2,538	2.4
June 1999	1,643	1,608	2.1	2,113	2,046	3.2	2,702	2,636	2.4
November 1999	1,615	1,520	6.3	2,003	1,883	6.4	2,531	2,380	6.3
Cereals and grains:									
October 1998	1,102	1,087	1.4	1,450	1,425	1.7	1,952	1,911	2.1
June 1999	1,143	1,143	.0	1,520	1,491	1.9	2,066	2,025	2.0
November 1999	1,088	1,044	4.2	1,393	1,305	6.7	1,787	1,686	6.0
Fruits and vegetables:									
October 1998	18	16	12.5	38	34	11.8	67	63	6.3
June 1999	20	13	53.4	39	30	30.0	65	54	20.4
November 1999	25	18	38.9	46	39	17.9	77	65	18.5
Meat and animal products:									
October 1998	36	33	9.1	79	77	2.5	168	163	3.0
June 1999	40	33	21.2	84	69	21.7	171	148	15.5
November 1999	50	40	25.0	99	84	17.8	186	176	5.7
Other foods:									
October 1998	243	240	1.2	340	340	.0	481	473	1.7
June 1999	254	242	4.9	363	345	5.0	485	485	.0
November 1999	279	274	1.8	372	368	1.0	543	545	−.1

Note. Descriptive statistics are based on the October 1998, June 1999, and November 1999 ENCEL surveys. Centiles are based on caloric availability. Sample size is approximately 8,200 treatment and 5,000 control households. Sample excludes 221 households reporting no food consumed at home and 10% of consumption records with caloric availability per person per day less than 875 kcal or greater than 4,700 kcal.

Second, there is a statistically significant difference in the unconditional means across these poor households, but the magnitude of the difference is small. However, as we move from October 1998 to June 1999, and then on to November 1999, the magnitude of these differences increases. By November 1999, the median households receiving PROGRESA benefits have 6.4% more calories available per person per day than do comparable households in control localities. Particularly striking are the increases in calories consumed from vegetables and fruits and meat and animal products. Proportionately, the largest impacts are found for fruits, vegetables, meat, and animal products for the poorest beneficiary households, as measured by households at the twenty-fifth percentile.

B. Modeling Impact in a Multivariate Framework

As noted in Section II, Behrman and Todd (1999) found that at the locality level, there are no significant differences between treatment and control communities across a range of characteristics that include age, education, access to health care, and income. However, when these tests are performed on household-level data, they find many more rejections of the null hypothesis of no differences across control and treatment localities than would be expected by chance. Also recall our finding that a significant proportion of households that were enrolled in treatment communities received no monetary transfers. For these reasons, we now turn to a parametric analysis of the impact of PROGRESA on caloric acquisition.

For our sample, based on households eligible for PROGRESA benefits in treatment and control localities within any given survey round, we specify a linear regression of the form

$$\ln \mathrm{PCCA}(i,v) = \alpha + \beta T + \gamma \tilde{X}(i,v) + \eta(i,v), \tag{1}$$

where PCCA denotes caloric availability in household i in locality v; α, β, and γ are fixed parameters; T is a binary variable equal to one if the household resides in a treatment community and zero otherwise; $\tilde{X}$ is a vector of household/community characteristics; and η is an error term summarizing the influence of random disturbances. The elements of the vector $\tilde{X}$ are household demographic characteristics (the logarithm of household size, proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; and women 55 and older), characteristics of the household head (education, age, occupation, ethnicity, marital status, and gender), and locality-level prices of tomatoes, onions, leafy vegetables, oranges, tortillas, corn, milk, white bread, local bread, rice, beans, chicken, and eggs.

The variables contained in $\tilde{X}$ allow us to condition out the impact of these confounding factors on the impact of PROGRESA.

With this simple specification, for an eligible household residing in a treatment locality, the expected value of lnPCCA for a given survey round is given by

$$E(\ln \text{PCCA}(i,v)|T = 1) = \alpha + \beta + \gamma\tilde{X}(i,v). \quad (2)$$

Similarly, for a household eligible for PROGRESA but located in a control locality, the expected value of lnPCCA is given by

$$E(\ln \text{PCCA}(i,v)|T = 0) = \alpha + \gamma\tilde{X}(i,v). \quad (3)$$

The difference in the conditional expectation of lnPCCA between PROGRESA-eligible households in treatment localities and PROGRESA-eligible households in control localities, summarized by the estimate of the parameter β, that is,

$$E(\ln \text{PCCA}(i,v)|T = 1) - E(\ln \text{PCCA}(i,v)|T = 0) = \beta, \quad (4)$$

can be considered as the impact of eligibility for PROGRESA benefits, or the mean "intended" treatment of the treated effect.

We also need to consider the nature of the disturbance term. In order to capture the role of regional differences in characteristics, the error term for each household is decomposed as follows:

$$\eta(i,v) = \mu(v) + \varepsilon(i). \quad (5)$$

Variation arising from regional differences that are common for all households in the same community is denoted by $\mu(v)$, while variation arising from other random shocks is denoted by $\varepsilon(i)$. In our data, there are three levels of geographic aggregation above the household: the immediate locality or community in which the household resides; the region or *municipio* of which the locality is a part; and the state in which the *municipio* is located. Our sample consists of 506 localities found in 191 different municipalities spread across seven states. Note that because randomization was undertaken at the locality level, we cannot use locality-level fixed effects estimates. Doing so makes it impossible to identify the impact of PROGRESA eligibility (recall that our sample consists only of PROGRESA-eligible households in treatment and control localities). Accordingly, we estimate *municipio* fixed effects regressions and include locality-level food prices to capture heterogeneity at the local or community level.[5]

[5] Hausman (1978) tests consistently reject the random effects estimator in favor of the state or municipality fixed effects estimator; hence, only the latter is reported here.

C. The Impact of PROGRESA on Caloric Availability

Our estimates of the impact of eligibility for PROGRESA benefits, summarized by the estimates of the parameter β, the core findings of this article—are found in table 3. These are reported separately by survey round for five outcomes: the log of total calories available per capita and the logs of calories available from cereals, vegetables, animal products, and other foods.

There is little evidence of much of a statistically significant impact on caloric availability as of October 1998. Given that PROGRESA had begun only limited operations at the time of this survey, such a result is not surprising. By contrast, the estimates for June and November 1999 are increasing in magnitude and significant at the 95% confidence level. By June 1999 households eligible for PROGRESA benefits in treatment localities obtained 3.3% more calories than did comparable households in control localities; this effect is slightly higher in November 1999. But it is also important to note that the impact is greatest on the acquisition of calories from vegetable and animal products. In the June and November 1999 rounds, PROGRESA-eligible households in treatment localities consumed between 10% and 17.5% more calories from these food sources than did comparable households in control localities. This is consistent with the view of respondents cited at the beginning of this section that PROGRESA was enabling them to "eat better." Further, these are conservative estimates in that they are based on a sample of eligible households in treatment localities—that is, they measure the "intent to treat" effect—and thus, as explained in Section II, include a significant number of households who did not in fact receive any monetary benefits from PROGRESA.

D. Extensions

Other studies of the impact of PROGRESA such as Schultz (2004) and Skoufias and Parker (2001) use a difference-in-difference estimator. They can do so because, for the outcomes they consider, data were collected in both treatment and control localities before and after program initiation. As explained in Section II, a direct application of such an estimation strategy is not feasible here because detailed consumption data were not collected until after the program started. That said, the combined results of tables 1–3 suggest that at the time of the first survey with detailed consumption information, beneficiaries had received only a minimal level of transfers. Exploiting this information, it is possible for us to construct a "quasi difference-in-difference" estimator of program impact.[6] Specifically, we pool the eligible households

[6] Quasi because, for reasons explained in the text, we do not have a true "before" and "after" comparison.

TABLE 3

***MUNICIPIO* FIXED EFFECTS ESTIMATES OF THE IMPACT OF PROGRESA ELIGIBILITY ON PER CAPITA HOUSEHOLD CALORIC AVAILABILITY**

Impact of Eligibility for PROGRESA (Estimate of β in Eq. [1])	Log Total Calories	Log Calories from Grains	Log Calories from Fruit and Vegetables	Log Calories from Animal Products	Log Calories from Other Foods
October 1998	.005	−.002	.048	.017	.017
	(.72)	(.17)	(2.27)**	(.77)	(1.41)
June 1999	.033	.031	.175	.100	.000
	(4.50)**	(3.17)**	(8.48)**	(4.14)**	(.01)
November 1999	.034	.031	.157	.128	.007
	(5.41)**	(3.80)**	(8.31)**	(6.31)**	(.65)

Note. Sample consists of households eligible for PROGRESA benefits in treatment and control localities. Sample sizes are 13,142 (October 1998), 11,931 (June 1999), and 13,416 (November 1999). Sample excludes 221 households reporting no food consumed at home and 10% of consumption records with caloric availability per person per day less than 875 kcal or greater than 4,700 kcal. Regressors included not reported: log household size; proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; women 55 and older); characteristics of the head (education, age, occupation, ethnicity, marital status, gender); locality level prices of tomatoes, onions, leafy vegetables, oranges, tortillas, corn, milk, white bread, local bread, rice, beans, chicken, eggs. Absolute values of *t*-statistics are in parentheses.
** Significant at the 5% level.

from the October 1998 and November 1999 survey rounds and amend equation (1) to be

$$\ln \text{PCCA}(i,v,r) = \alpha + \beta T + \gamma R + \delta(T \cdot R) + \theta \tilde{X}(i,v,r) + \eta(i,v,r), \quad (1')$$

where R equals one if the household is observed in November 1999 and zero otherwise, and r denotes the survey round of observation for household i in locality v. In this specification, the estimate of the parameter δ is the "quasi" difference-in-differences estimate of the impact of PROGRESA, that is,

$$\begin{aligned} &[E(\ln \text{PCCA}(i,v,1) \mid T = 1, R = 1) - \\ &E(\ln \text{PCCA}(i,v,1) \mid T = 0, R = 1)] - \\ &[E(\ln \text{PCCA}(i,v,0) \mid T = 1, R = 0) - \\ &E(\ln \text{PCCA}(i,v,0) \mid T = 0, R = 0)] = \delta. \end{aligned} \quad (6)$$

The advantage of equation (1′) is that it can be estimated using household fixed effects. This is because the term $(T \cdot R)$ is time varying at the household level. The estimates of δ using fixed effects are reported in table 4.[7] Strikingly, these results are virtually identical to the impact estimates reported for the November 1997 survey in table 3, which suggests that the estimates reported in that table are not biased by the absence of controls for household fixed effects. The only noticeable change is that the impact estimate in the vegetables and fruit regression (0.123) is somewhat smaller than the comparable impact estimate in table 3 (0.157). However, recall that equation (1′) looks at differences between October 1998 and November 1999 and that in October 1998, PROGRESA-eligible households in treatment localities were already consuming more calories from this food source, whereas there was no discernible change in caloric acquisition from other sources. Consequently, we would expect the subsequent change in consumption of fruits and vegetables to be smaller.

To this point, our reported parameter estimates have been based on a specification that excludes the logarithm of household consumption (lnPCE) as an explanatory variable. As such, the estimates reported above represent the total impact of all PROGRESA components on caloric availability. However, it is of interest to separate out the impact of cash transfers from other program interventions. As noted in the introduction, one of the stated objectives of PROGRESA is to promote community participation and support for the actions of PROGRESA, so that educational and health services benefit all families in the localities where the program operates. Thus, as part of the program, in

[7] The specification of the $\tilde{X}$ vector is identical to that in eq. (1), i.e., including household age and gender composition and locality level prices.

TABLE 4

QUASI DIFFERENCE-IN-DIFFERENCE HOUSEHOLD FIXED EFFECTS ESTIMATES OF THE IMPACT OF PROGRESA ELIGIBILITY ON PER CAPITA HOUSEHOLD CALORIC AVAILABILITY, OCTOBER 1998–NOVEMBER 1999

	Log Total Calories	Log Calories from Grains	Log Calories from Fruit and Vegetables	Log Calories from Animal Products	Log Calories from Other Foods
Impact of eligibility for PROGRESA					
(estimate of δ in eq. [1′])	.036	.037	.123	.125	.008
	(4.37)**	(3.36)**	(5.11)**	(4.88)**	(.62)

Note. Sample consists of households eligible for PROGRESA benefits in treatment and control localities. Sample size is approximately 26,600. Sample excludes 221 households reporting no food consumed at home and 10% of consumption records with caloric availability per person per day less than 875 kcal or greater than 4,700 kcal. Regressors included not reported: log household size; proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; women 55 and older; characteristics of the head (education, age, occupation, ethnicity, marital status, gender); locality level prices of tomatoes, onions, leafy vegetables, oranges, tortillas, corn, milk, white bread, local bread, rice, beans, chicken, eggs. Absolute values of *t*-statistics are in parentheses.

** Significant at the 5% level.

the localities where PROGRESA operates there is a series of regular lectures, "*platicas*," where information and training on health and nutrition is given by a doctor and/or nurse from the health clinic serving the community. Attendance at these *platicas* is compulsory, and in the ENCEL surveys, PROGRESA-eligible households in treatment localities report near universal attendance.

Table 5 reports regression coefficient estimates using equation (1) but with lnPCE included as an additional explanatory variable. To conserve space, only the results of estimating this for the November 1999 round are reported here; estimates for the earlier rounds are available on request. It is important to note that the interpretation of impact has to be revised appropriately when PCE is included as an additional explanatory variable in the regression. In this case, β is the change in the conditional mean of lnPCCA after accounting for the potential increases in lnPCCA brought about by the cash transfers received from participating in the PROGRESA program. If it is assumed that there are no potential biases from correlated measurement errors between PCE and PCCA, then β provides an estimate of the impact of participation in the health- and nutrition-related lectures (*platicas*) on PCCA. Accordingly, we estimate

$$\ln \mathrm{PCCA}(i,v) = \alpha + \beta T + \gamma \tilde{X}(i,v) + \phi \ln \mathrm{PCE} + \eta(i,v). \qquad (1'')$$

Results are reported in table 5. There are four important findings. First, although participation in PROGRESA raises the amount of calories acquired from grains and "other foods," this would appear to be due to PROGRESA's income effect. Once we control for log per capita expenditures, there is no additional effect of PROGRESA on the acquisition of calories from these sources.

Second, participation in PROGRESA does have an impact on the acquisition of calories from fruits, vegetables, and animal products after controlling for its income effect. This is consistent with the fact that during these *platicas*, beneficiaries are encouraged to eat a more diverse diet, including more fruits, vegetables, and milk and other animal products. Note that this impact is observed after controlling for other confounding factors, including price changes, household characteristics, and fixed, municipality-level characteristics.

Third, the parameter estimates for log per capita consumption is 0.263, a figure within the preferred range of estimates reported by Strauss and Thomas (1995) in their review of the impact of changes in income and consumption on caloric availability. In preliminary work, we were concerned that this parametric specification might be obscuring nonlinearities in the consumption-caloric availability relationship. As a check, we ran nonparametric regressions

TABLE 5

MUNICIPIO FIXED EFFECTS ESTIMATES OF THE IMPACT OF PROGRESA ELIGIBILITY ON PER CAPITA HOUSEHOLD CALORIC AVAILABILITY IN NOVEMBER 1999, LOG PER CAPITA CONSUMPTION INCLUDED

	Log Total Calories	Log Calories from Grains	Log Calories from Fruit and Vegetables	Log Calories from Animal Products	Log Calories from Other Foods
Exogenous:					
Log per capita consumption	.263	.187	.841	.905	.238
	(51.21)**	(26.16)**	(54.48)**	(53.90)**	(25.78)**
Impact of PROGRESA *platicas* (estimate of β in eq. [1″])	.018	.020	.107	.071	−.007
	(3.19)**	(2.50)**	(6.23)**	(3.86)**	(.72)
Endogenous:					
Log per capita consumption	.387	.330	.994	1.272	.053
	(2.30)**	(1.42)	(1.99)**	(2.47)**	(.18)
Impact of PROGRESA *platicas* (estimate of β in eq. [1″])	.011	.011	.097	.047	.004
	(.95)	(.71)	(2.82)**	(1.26)	(.18)

Note. Sample consists of households eligible for PROGRESA benefits in treatment and control localities. Sample size is 13,416. Sample excludes 221 households reporting no food consumed at home and 10% of consumption records with caloric availability per person per day less than 875 kcal or greater than 4,700 kcal. Regressors included not reported: log household size; proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; women 55 and older; characteristics of the head (education, age, occupation, ethnicity, marital status, gender); locality level prices of tomatoes, onions, leafy vegetables, orange, tortillas, corn, milk, white bread, local bread, rice, beans, chicken, eggs. Absolute values of *t*-statistics are in parentheses.

** Significant at the 5% level.

to explore further this relationship. We found a positive and statistically significant relationship between consumption and calories, with elasticities ranging from 0.3 to 0.5. Although there is a nonlinearity in this relationship, it appears at consumption levels well above those observed in PROGRESA-eligible households.

Two concerns remain. If PROGRESA eligibility causes households to alter labor supply, then consumption levels become endogenous and the parameter estimates reported in table 5 are biased. Even if this is not the case (and Parker and Skoufias [2000] suggest that PROGRESA did not have significant disincentive effects on adult labor supply), measurement errors in food consumption (affecting the dependent variable) have a particularly pernicious effect in this specification, given that food consumption is the largest component of total consumption, implying correlation between the disturbance term and lnPCE and thus biased parameter estimates.

Instrumental variables estimation can overcome both concerns. The difficulty, however, is finding an instrument that is correlated with per capita consumption but does not directly affect caloric availability. Our starting point for finding such instruments in these data is an observation found in Singh, Squire, and Strauss (1986), that if markets are well functioning, household agricultural incomes are separable or independent of household consumption decisions. We identify a component of these agricultural incomes, the value of sales of agricultural products, which varies over time and across households and is available for all survey rounds. The validity of value of agricultural products sold as an instrument can be tested formally using the approach outlined by Bound, Jaeger, and Baker (1995). We obtain an F-statistic of 11.89 on this instrument in the first-stage regression, comfortably exceeding their rule-of-thumb figure of 10. An overidentification test based on Davidson and MacKinnon (1993) indicates that the joint null hypotheses, that the instruments are uncorrelated with the errors, and that the second-stage equation is correctly specified, cannot be rejected.

Municipio fixed effects regressions with log per capita consumption treated as endogenous are reported in the lower part of table 5. In general, the parameter estimates for caloric availability are higher when we treat lnPCE as endogenous (with the exception of calories from other foods), the *platica* effects are lower, and the parameters are less precisely measured. However, the *platica* effect for fruit and vegetables remains largely unchanged, and there is no statistically significant difference in the parameter estimates from the fixed effects and instrumental variables fixed effects regressions for caloric availability from animal products.

There is another, albeit indirect, way of looking at the impact of these *platicas*.

If information flows relatively freely within these communities, and the information on good dietary practices is believed, then one would expect changes in caloric consumption among non-PROGRESA-eligible households in treatment localities. And there is a further advantage of doing so; if PROGRESA-eligible households are responding strategically to the household survey—merely "talking a good diet" rather than actually changing behavior—then we should not observe nonincome program effects among noneligible households conditional on per capita expenditures, observable household characteristics, prices, and *municipio* fixed effects. When we estimate equation (1″) but restrict the sample to non-PROGRESA-eligible households in treatment and control localities, we get positive and significant parameter estimates of the *platica*, albeit somewhat smaller in magnitude. This is consistent with the possibility of there being some informational spillovers to noneligible households and casts some doubt on the notion that eligible households are responding strategically in the household surveys.[8]

Finally, we examined the impact on households with preschool children. A further component of PROGRESA benefits is the *papilla* nutritional supplement that is distributed to households containing pregnant and lactating women and children between the ages of 4 months and 2 years, and to children between 2 and 5 years if any signs of malnutrition are detected. (These supplements also are given to non-PROGRESA households under similar circumstances; if this occurs in control communities in the evaluation sample, it biases downward the estimated impact of PROGRESA because both treatment and control children are receiving this part of the treatment.) Mothers visit the clinic at least once a month (more if they are pregnant or have small children) to pick up six packets of supplements per child per month, with each packet containing five doses, enough for one dose per day. The supplements constitute 20% of calorie requirements and 100% of all necessary micronutrients.

A possible concern is that the provision of the *papilla* may cause households to divert expenditures on food to other items, thus undercutting efforts to increase caloric availability in these households. If the *papilla* is truly "crowding out" household acquisition of calories, we would expect to see lower measures of impact for households with preschool children. The results of estimating equation (1)—presented in table 6—suggest that such concerns are unfounded; the impact of participation in PROGRESA on caloric acquisition is, if anything, slightly higher for these households. The impact on caloric acquisition from vegetables, fruits, and animal products is particularly striking given

[8] Results are available on request.

TABLE 6

MUNICIPIO FIXED EFFECTS ESTIMATES OF PROGRESA ELIGIBILITY ON PER CAPITA HOUSEHOLD CALORIC AVAILABILITY IN NOVEMBER 1999, HOUSEHOLDS WITH PRESCHOOL CHILDREN ONLY

	Log Total Calories	Log Calories from Grains	Log Calories from Fruit and Vegetables	Log Calories from Animal Products	Log Calories from Other Foods
Impact of eligibility for PROGRESA					
(estimate of β in eq. [1])	.046	.033	.219	.174	.035
	(5.29)**	(2.98)**	(8.39)**	(6.20)**	(2.40)**

Note. Sample consists of households eligible for PROGRESA benefits in treatment and control localities with at least one resident child age less than 5 years. Sample size is 7,731. Sample excludes 221 households reporting no food consumed at home and 10% of consumption records with caloric availability per person per day less than 875 kcal or greater than 4,700 kcal. 3. Regressors included not reported: log household size; proportions of children 0–2, 3–5; boys 6–7, 8–12, 13–18; girls 6–7, 8–12, 13–18; women 19–54; men 55 and older; women 55 and older; characteristics of the head (education, age, occupation, ethnicity, marital status, gender); locality level prices of tomatoes, onions, leafy vegetables, oranges, tortillas, corn, milk, white bread, local bread, rice, beans, chicken, eggs. Absolute values of *t*-statistics are in parentheses.
** Significant at the 5% level.

evidence that in Mexico poor-quality diets inhibit the physical growth and cognitive development of children under 30 months (Allen 1991, 2003).

IV. Conclusion

Mexico's flagship antipoverty program, PROGRESA, has been the subject of extensive review showing that, inter alia, it improves schooling and child nutrition outcomes (Behrman and Hoddinott 2004; Schultz 2004).[9] In this article, we have examined the impact of PROGRESA on household food consumption. Our empirical strategy was motivated by the need to be conscious of the survey design with which we worked, the actual manner in which PROGRESA operated in the field, and the need to adequately control for confounding factors. Controlling for differences in household and municipality characteristics, as well as differences in prices, we find that there is no evidence of a statistically significant impact on caloric availability as of October 1998. Given that PROGRESA had begun only limited operations at the time of this survey, such a result is not surprising. However, there is evidence of a significant impact in June and November 1999. For example, in November 1999, the median household eligible for PROGRESA benefits in treatment localities obtained 6.4% more calories than did comparable households in control localities. The impact is greatest on the acquisition of calories from vegetable and animal products.

Although participation in PROGRESA raises the amount of calories acquired from grains and "other foods," this would appear to be due to PROGRESA's income effect. The estimates in table 5 suggest that participation in PROGRESA does have an impact on the acquisition of calories from fruits, vegetables, and animal products even after controlling for its income effect. This is consistent with another dimension of the program, the fact that during a regular series of lectures, called "*platicas*," beneficiaries are encouraged to eat a more diverse diet, including more fruits, vegetables, milk, and other animal products. There is some evidence that information conveyed during these *platicas* spills over and positively affects the behavior of nonbeneficiaries in treatment localities. Further, it is observed in households with preschool children. This latter finding is particularly significant given that in Mexico, poor-quality diets inhibit the physical and cognitive growth of children younger than 30 months. More generally, these results suggest that efforts to reduce poverty in the developing world will also reduce hunger.

[9] A full summary of the first set of evaluations is found in Skoufias (2001).

References

Adato, Michelle, David Coady, and Marie Ruel. 2000. "An Evaluation of PROGRESA in Mexico at the Level of Beneficiaries, Communities, and Institutions. Report Submitted to PROGRESA." Mimeograph, International Food Policy Research Institute, Washington, DC.

Allen, Lindsay. 1991. "An Analytical Approach for Exploring the Importance of Dietary Quality vs. Quantity to the Growth of Mexican Children." *Food and Nutrition Bulletin* 13 (June): 95–104.

———. 2003. "Interventions for Micronutrient Deficiency Control in Developing Countries: Past, Present and Future." *Journal of Nutrition* 133 (November): 3875S–3878S.

Behrman, Jere, and John Hoddinott. 2004. "Program Evaluation with Unobserved Heterogeneity and Selective Implementation: The Mexican PROGRESA Impact on Child Nutrition." Mimeograph, International Food Policy Research Institute, Washington, DC.

Behrman, Jere, and Petra Todd. 1999. "Randomness in the Experimental Samples of PROGRESA: Report Submitted to PROGRESA." Mimeograph, International Food Policy Research Institute, Washington, DC.

Bound, John, David Jaeger, and Regina Baker. 1995. "Problems with Instrumental Variables Estimation When the Correlation between the Instruments and the Endogenous Explanatory Variables Is Weak." *Journal of the American Statistical Association* 90:443–50.

Chernichovsky, Dov, and Meesook Oye Astra. 1984. "Urban-Rural Food and Nutrition Consumption Patterns in Indonesia." World Bank Staff Working Paper no. 670, World Bank, Washington, DC.

Davidson, Russell, and James MacKinnon. 1993. *Estimation and Inference in Econometrics*. New York: Oxford University Press.

Gomez de Leon, Jose, Susan W. Parker, Daniel Hernandez, Patricia Muniz, and Monica Orozco. 1999. "The Design and Methodology of the Impact Evaluation of the Education, Health and Nutrition Program (PROGRESA) in Mexico." Mimeograph, PROGRESA, Mexico City.

Hausman, Jerry. 1978. "Specification Tests in Econometrics." *Econometrica* 46 (November): 1251–70.

Hoddinott, John, Emmanuel Skoufias, and Ryan Washburn. 2000. "The Impact of PROGRESA on Consumption: Report Submitted to PROGRESA." Mimeograph, International Food Policy Research Institute, Washington, DC.

Muñoz de Chávez, Miriam, José Antonio Roldán, José Angel Ledesma, Eduardo Mendoza, Adolfo Chávez, Fernando Perez-Gil, Sonia Hernández, and Alejandra Chaparro. 1996. *Tablas de valor nutrivo de los alimentos de mayor consumo en México*. México City: Edición Internacional.

Parker, Susan W., and Emmanuel Skoufias. 2000. "The Impact of PROGRESA on Work, Leisure and Time Allocation: Report submitted to PROGRESA." Mimeograph, International Food Policy Research Institute, Washington, DC.

PROGRESA. 1997. *PROGRESA: Programa de educación, salud y alimentación*. Mexico City: PROGRESA.

Ravallion, Martin. 1990. "Income Effects on Undernutrition." *Economic Development and Cultural Change* 38 (April): 489–515.

Ruel, Marie. 2001. "Can Food Based Strategies Help Reduce Vitamin A and Iron Deficiencies?" Mimeograph, International Food Policy Research Institute, Washington, DC.

Schultz, T. Paul. 2004. "School Subsidies for the Poor: Evaluating the Mexican Progresa Poverty Program." *Journal of Development Economics* 74:199–250.

Singh, Inderjit, Lyn Squire, and John Strauss. 1986. *Agricultural Household Models: Extensions, Applications and Policy*. Baltimore: Johns Hopkins University Press.

Skoufias, Emmanuel. 2001. "PROGRESA and Its Impacts on the Welfare and Human Capital of Adults and Children and Rural Mexico: A Synthesis of the Results of an Evaluation by the International Food Policy Research Institute." International Food Policy Research Institute, Washington, DC.

Skoufias, Emmanuel, Benjamin Davis, and Sergio de la Vega. 2001. "Targeting the Poor in Mexico: Evaluation of the Selection of Beneficiary Households into PROGRESA." *World Development* 29 (October): 1769–84.

Skoufias, Emmanuel, and Susan W. Parker. 2001. "Conditional Cash Transfers and Their Impact on Child Work and Schooling: Evidence from the PROGRESA Program in Mexico." *Economica* 2 (Fall): 45–96.

Strauss, John, and Duncan Thomas. 1995. "Human Resources: Empirical Modeling of Household and Family Decisions." In *Handbook of Development Economics*, vol. 3, ed. J. Behrman and T. N. Srinivasan. Amsterdam: North-Holland.

United Nations. 2000. "United Nations Millennium Declaration." Resolution of the United Nations General Assembly, A/RES/55/2.

Wolfe, Barbara, and Jere Behrman. 1983. "Is Income Overrated in Determining Adequate Nutrition?" *Economic Development and Cultural Change* 31 (April): 525–49.